

WHY WAIT?: EXAMINING DELAYED WIC PARTICIPATION AMONG PREGNANT WOMEN

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Despite the benefits of prenatal participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), many eligible women either do not participate or begin participation late in their pregnancies. Using recent nationally representative data, we find that more disadvantaged women are more likely to access WIC and, with some notable exceptions, to participate earlier in their pregnancies. Hispanic women, especially those with language difficulties, enroll in WIC later in their pregnancies. Early WIC participation, particularly among teenagers, is less likely among women experiencing a first birth and depends on the mother's early recognition of her pregnancy. (JEL I18, I30)

I. INTRODUCTION

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides nutritious foods, nutrition counseling, and referrals to health and other social services to low-income women and their infants and children up to age 5. The program was established as a pilot program in 1972 and has grown from serving 88,000 participants in fiscal year 1974 to approximately 8.1 million in fiscal year 2006 (U.S. Department of Agriculture [USDA], 2007). Approximately 941,000 pregnant women participated in WIC during April 2004, comprising 11% of WIC participants (USDA, 2006a).

A substantial body of research finds that women who participated in WIC during their pregnancy have better birth outcomes than low-income women who did not. Fox, Hamilton, and Lin (2004) review 38 studies conducted since the late 1970s and conclude that the

research provides evidence that WIC has a positive impact on several key birth outcomes such as low birthweight, mean birthweight, and mean gestational age. More recent studies provide further evidence of the positive impact of WIC on birth outcomes (e.g., Bitler and Currie, 2005).

There is also evidence that earlier participation in WIC by pregnant women results in greater improvements in birth outcomes than later participation (Ahluwalia et al., 1998; Brien and Swann, 2001; Buescher et al., 1993; Devaney, Bilheimer, and Schore, 1992; Edozien, Switzer, and Bryan, 1979; Finch, 2003; Kennedy et al., 1982; Lazariu-Bauer et al., 2004; Schramm, 1986). Most recently, Lazariu-Bauer et al. (2004) find an increase in birthweight among infants born to early prenatal WIC entrants compared to late entrants, with the greatest increases among more disadvantaged populations. In addition, studies suggest that early receipt of prenatal care

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ABBREVIATIONS

ECLS-B: Early Childhood Longitudinal Study-Birth Cohort

NCES: National Center for Education Statistics

NMHS: National Maternal and Infant Health Survey

SSI: Supplemental Security Income

TANF: Temporary Assistance for Needy Families

USDA: U.S. Department of Agriculture

WIC: Special Supplemental Nutrition Program for Women, Infants, and Children

has a positive impact on birth outcomes (Evans and Lien, 2005; Kotelchuck, 1994).

Despite the health benefits of prenatal WIC participation and especially participation that begins early in the pregnancy, not all eligible women take up during pregnancy and some prenatal participants do not take up until later in their pregnancies. In 2003, 69.6% of eligible pregnant women participated (USDA, 2006b). Among prenatal participants in April 2004, 48.1% did not enroll until after their first trimester (USDA, 2006a). Many eligible nonparticipants and late entrants exhibit need for program benefits, despite their lack of participation. Swann (2007) finds that almost 19% of eligible prenatal nonparticipants experiencing their first pregnancy had annual income below \$5,000 in 1988, when the poverty threshold for a single-person household was \$5,770. Finch (2003) finds that 55% of late prenatal WIC entrants in 1988 had income below the poverty line. Understanding the characteristics associated with WIC participation and, in particular, early participation can help target program resources and outreach efforts more effectively. In addition, although WIC is a Federal program, states have some discretion over program design and operation. Understanding the interaction between state-level WIC policies and the timing of participation may inform decisions regarding state-level policy design.

Further, there has been some debate over the role WIC participation itself plays in the improvement in birth outcomes (Besharov and Germanis, 2001; Joyce, Gibson, and Colman, 2005). One of the underlying issues in this debate is whether WIC participants would be more likely to have better birth outcomes than eligible nonparticipants, regardless of whether they participated in WIC.¹ A more thorough understanding of the factors associated with WIC participation, as well as the timing of participation, can contribute to the debate over the effectiveness of WIC.

This research uses a recently released data set, the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B), with extensive information on household characteristics to examine prenatal participation in WIC among eligible women. Specifically, we address the following

two research questions: (1) What factors are associated with any prenatal WIC participation? and (2) What factors are associated with early prenatal WIC participation? Our findings support earlier research that prenatal WIC participants are more disadvantaged than eligible nonparticipants and provide further evidence of negative selection on a wider array of observable characteristics than have previously been included in studies of prenatal WIC participation. In addition, we find that some of the factors that influence any prenatal WIC participation also influence early prenatal WIC participation, which suggests that WIC participants who enroll earlier in their pregnancy are more disadvantaged over some dimensions than those who enroll later. However, there are some notable differences between the results examining any participation and early participation. Hispanic women, especially those with language difficulties, enroll in WIC later in their pregnancies. Early WIC participation, particularly among teenagers, is less likely among women experiencing a first birth and depends on the mother's early recognition of her pregnancy.

II. THE WIC PROGRAM

A. Background

WIC provides food and services to pregnant and postpartum women, infants up to 12 mo of age, and children 1–5 yr of age. In addition to belonging to one of these categories, an individual must also meet two other criteria to be eligible to receive WIC: (1) live in a household with income at or below 185% of the Federal poverty guideline or be enrolled in another assistance program (i.e., Food Stamp Program, Temporary Assistance for Needy Families [TANF], or Medicaid) and (2) be assessed as nutritionally at risk. Two major types of nutritional risk are recognized for WIC eligibility: (1) medically based risks such as anemia, underweight, or history of pregnancy complications or poor pregnancy outcomes and (2) diet-based risks such as failure to meet dietary guidelines. Pregnant women certified as eligible do not have to recertify eligibility until 6 wk postpartum. WIC food packages are designed to provide participants with protein, calcium, iron, and vitamins A and C. The food package for pregnant women contains milk and/or cheese,

1. A related issue is the appropriate measure of birth outcomes (Joyce, Gibson, Colman, 2005), but we do not address this issue.

eggs, cereal, peanut butter and/or dried beans, and fruit or vegetable juice. For additional information on WIC eligibility and benefits, see the USDA Food and Nutrition Service web site at <http://www.fns.usda.gov/wic/howtoapply/eligibilityrequirements.htm>.

B. Literature

Recent studies have examined the factors associated with prenatal WIC participation as part of an effort to estimate the effect of WIC on birth outcomes (Bitler and Currie, 2005; Brien and Swann, 2001; Kowaleski-Jones and Duncan, 2000).² Two other recent studies examine the correlates of WIC participation, though their primary focus is not prenatal participation (Bitler, Currie, and Scholz, 2003; Chatterji et al., 2002).³

While these studies use a number of different data sources and methodologies, they have produced some consistent findings on the factors associated with prenatal WIC participation. Prenatal WIC participation is more likely among non-Hispanic blacks and Hispanics than among non-Hispanic whites. Prenatal WIC participation decreases with age and education. In addition, studies that incorporated information on WIC program characteristics have found that prenatal WIC participation is lower among women in states in which a woman must provide income documentation to establish eligibility, and is higher in states in which receipt of cash welfare confers automatic income eligibility for WIC.

There has been considerably less research on the timing of prenatal WIC participation. Two previous studies focus on the factors related to early prenatal WIC participation. Ku (1989) examines a 1984 sample of prenatal participants and finds that early prenatal WIC participation is much more likely among women who participated previously. Swann (2007) is the only previous study to examine the timing of prenatal participation using nationally representative survey data. He uses the 1988

National Maternal and Infant Health Survey (NMIHS), and finds a strong positive association between previous WIC participation and early WIC participation. He also finds that early participation in WIC is associated with having low income; a low level of education; no private insurance; and with being Hispanic, younger, or a single mother. Thus, more disadvantaged women are more likely to participate in WIC early. State WIC policies also influence early participation.

A number of changes have occurred since 1988 that could potentially affect participation in WIC and the timing of prenatal WIC participation. The funding level for WIC has increased so that waiting lists are quite rare (Ver Ploeg and Betson, 2003), increasing access to the program. Furthermore, the income eligibility criteria for pregnant women to receive Medicaid have become less stringent over time (National Governors Association Center for Best Practices, 2001). Since Medicaid recipients are automatically income eligible for WIC, this has changed the composition of the WIC-eligible population. The Federal government has also instituted more uniform eligibility requirements—including mandatory income documentation and standardized nutritional risk criteria. Along with these policy changes, WIC participation patterns have also changed. From April 1992 to April 2002, the number of pregnant women participating in WIC increased from 781,029 to 878,619, and the percent of women who enter in their first trimester has increased from 33.7 to 48.4 (USDA, 1998, 2003).

It is important to examine prenatal WIC participation and the timing of participation in this new policy environment. The rich information in the ECLS-B data allows us to explore a number of determinants of any and early prenatal WIC participation that have not been examined previously. We also build on previous research with our use of nationally representative data that allow us to clearly identify prenatal participants.

III. DATA

A. Early Childhood Longitudinal Study-Birth Cohort

The primary data source for this study is the ECLS-B. The ECLS-B is a longitudinal data set collected by the National Center for

2. Most of these studies, as well as Kowaleski-Jones and Duncan (2002), employ a number of techniques to address the possible selection bias in estimating the effect of WIC on birth outcomes. However, the results of their estimation of prenatal WIC participation are of primary interest to this study.

3. Chatterji et al. (2002) examine WIC participation during the year of a child's birth (i.e., end of pregnancy and immediately after birth) as part of a study that examines the effect of WIC on breastfeeding.

Education Statistics (NCES). The baseline sample of 10,700 children was designed to be nationally representative of children born in 2001 with oversamples of children who are American Indian, Chinese, a member of another Asian and Pacific Islander group, a twin, and low- and very low-birthweight children.⁴ To date, the first two waves (9-mo and 2-yr data collection) of survey data are available. This study uses information collected during the first wave. For additional information on the ECLS-B, see the survey instruments available from NCES.⁵

Given the broad motivations of the ECLS-B that include understanding children's health care and status, growth and development, transitions to child care and early childhood education programs, and school readiness, these data are quite rich. In the first wave of data, information is collected from children, both parents, including nonresidential fathers, and birth certificates. Pertinent to this paper, the ECLS-B contains information on the timing of prenatal WIC participation, demographic characteristics, income and assets, participation in other assistance programs, and health status and behaviors.

B. Additional Data Sources

Because some WIC policies vary at the state level, we use data on 2000 state policies from the *WIC Participant and Program Characteristics 2000* (USDA, 2002). State policies of interest include the benefits of WIC food packages (e.g., the value of the food package) and the transactions costs of enrolling in WIC and receiving the food packages (e.g., whether the WIC voucher is issued monthly or less frequently). We also use information on the number of WIC-only stores (which stock only WIC food items and serve only WIC customers) in the state from *The Integrity Profile Report for Fiscal Year 2000* (USDA, 2001). More information on WIC state policies and practices is given in the Appendix.

While the women studied in the ECLS-B gave birth in 2001, we use state policy data from 2000 for two reasons. First, while all

the children in the sample were born during 2001, many of their mothers were pregnant during 2000. Women pregnant in 2000 would have faced the 2000 rules and would have potentially made participation decisions based on them in 2001. Second, it is unlikely that WIC state policies changed between 2000 and 2001, given evidence from Bitler and Currie (2005) and USDA (2002) that there was little change in these policies over the 1990s.⁶

The third additional source of 2000 data is the *Maternal and Child Health Update: States Have Expanded Eligibility and Increased Access to Health Care for Pregnant Women and Children* (National Governors Association Center for Best Practices, 2001). Medicaid participants are deemed adjunctively eligible for WIC, and the income threshold for Medicaid varies by state and can be higher than the income threshold for WIC eligibility. Therefore, we use the state Medicaid income eligibility thresholds for pregnant women to determine eligibility for the program.

Data on the 2000 state unemployment rates are from the U.S. Bureau of Labor Statistics and the 2000 state poverty rates are from the U.S. Census Bureau.

C. Coding WIC Eligibility

As discussed earlier, to be eligible to receive WIC services, a pregnant woman must meet income and nutritional risk requirements. To determine whether a woman's income is less than or equal to 185% of the poverty threshold, her household income-to-poverty ratio is calculated using household income over the year prior to the survey and household size, according to the U.S. Department of Health and Human Services poverty guidelines. Because the income information is bracketed, the midpoint of each bracket is used to calculate her household income-to-poverty ratio. If the state's income threshold for Medicaid is higher than 185% of the income-to-poverty ratio, we use that threshold to determine eligibility. All women who report prenatal Medicaid participation are considered automatically income eligible for WIC.

There are some limitations to using the ECLS-B for coding WIC eligibility. First, the

4. Approximately 14,000 children were sampled, which resulted in 10,700 completed cases. All unweighted sample sizes are rounded to the nearest 50 per NCES rules governing use of restricted data.

5. Survey instruments are available from NCES at <http://nces.ed.gov/ecls/Birth.asp>.

6. The *WIC Participant and Program Characteristics 2002* report does not provide updated information on WIC state policies; therefore, it is not possible to compare 2000 and 2002 policies (USDA, 2003).

ECLS-B does not include data to determine whether a woman is at nutritional risk. However, this should not affect results from the study as nearly all income-eligible individuals are also at nutritional risk (Ver Ploeg and Betson, 2003). Second, using the midpoint of the income brackets means that a woman whose income falls within an income bracket that contains the relevant eligibility threshold may be assigned the wrong eligibility status. We test other methods of coding eligibility, including a more restrictive measure that considers only households whose income is below the bracket that contains the WIC eligibility threshold as eligible. We find that the primary regression results are not sensitive to our choice of eligibility definition.

Third, respondents report their household income for the year prior to the survey. While WIC agencies have wide discretion over the time period used to determine a household's income, Bitler, Currie, and Scholz (2003) suggest that most agencies use monthly income to calculate eligibility. Ver Ploeg and Betson (2003) note that, given WIC certification periods, the use of annual income to determine eligibility will underestimate the number of eligible households because households with annual income above 185% of the poverty guideline but at least 1 mo of income eligibility will be misclassified as ineligible. We find that 300 women in the sample reported prenatal WIC participation but are coded as ineligible.⁷ In addition, because respondents report their household income for the year prior to the 9-mo survey, the reporting period for income covers the late pre- and postnatal periods. This may cause misclassification of eligibility, particularly among women who worked during pregnancy but not after giving birth.

Fourth, the ECLS-B does not have information on prenatal participation in the Food Stamp Program or TANF. This will lead us to misclassify as ineligible women who have annual income above 185% of the poverty line but who participated in either the Food Stamp Program or TANF in the prenatal period. Given the stricter eligibility criteria for these two programs, this type of misclassification is likely to be minimal.

7. There are other explanations for the presence of 300 ineligible WIC participants in the ECLS-B, such as misreporting of income to the WIC agency or misreporting of income or WIC participation in the ECLS-B.

D. Analysis Sample

To perform our analysis, we construct an analysis sample of 5,250 pregnant women eligible for WIC. Women must meet the following six inclusion criteria, with the number of observations excluded for each criterion given in parentheses. First, only observations with state identifiers are included (100). Second, only mothers with biological children are included (150). Third, mothers with multiple births were included as a single observation (800). Fourth, only mothers whose survey child is 18 mo of age or less at the time of assessment are included (50). We exclude mothers of infants older than 18 mo because we cannot ascertain their prenatal WIC participation status due to the structure of the survey. Fifth, only observations with complete information for all relevant variables are included (500).⁸ Sixth, only mothers who are determined to be eligible for WIC are included (3,850).⁹

Table 1 illustrates the main characteristics of the analysis sample. We find that 41% of U.S. women who gave birth in 2001 participated in WIC while they were pregnant. Not surprisingly, women who were eligible to receive WIC (both participants and nonparticipants) are more disadvantaged on average than all women who gave birth in 2001.

Respondents to household surveys tend to underreport participation in means-tested transfer programs. Although the ECLS-B probably does not capture all prenatal WIC

8. There were five variables that had missing information for 40 or more observations. We assign the modal value to each missing data point. Since there is some evidence that the missing values for these five variables are not occurring randomly, we include a variable that indicates whether the observation is missing data for that variable. The missing data indicator variables are (1) household invests, (2) household has a checking or savings account, (3) mother received welfare either some/half of the time or most/all the time as a child, or (4) survey child is firstborn. The coefficient estimates and their statistical significance are included in the notes to Tables 3 and 6. We also examine whether the sample of respondents who are excluded from the analysis because of missing data is different from the analysis sample and find very few differences. Those with missing data are more likely to be Asian and somewhat less likely to be non-Hispanic black or non-Hispanic white, but we find no differences in education, age, marital status, or household income.

9. Women who participated in WIC, but are coded as ineligible, are excluded from the analysis sample. Because these 300 ineligible participants are significantly better-off on average than eligible women and we cannot determine why they are misclassified, we exclude them from the analysis.

TABLE 1
Characteristics of Pregnant Women by WIC Eligibility and Participation

Characteristics	All Women	Eligible Women	Eligible Participants	Eligible Nonparticipants
WIC participation	41.0	68.0	100.0	0.0
Mother's race/ethnicity				
Non-Hispanic white	57.3	42.0	38.4 ^a	49.7
Non-Hispanic black	14.1	20.0	22.4 ^a	15.1
Hispanic	22.8	32.7	34.6 ^a	28.5
Asian	3.3	2.3	1.4 ^a	4.2
Other race	2.5	3.0	3.2	2.5
Mother's education				
Less than high school	27.3	43.6	48.5 ^a	33.4
High school graduate	21.9	28.0	29.0	25.9
Some college or vocational degree	26.4	23.1	19.9 ^a	29.8
College graduate	24.4	5.3	2.6 ^a	11.0
Mother's age (yr)				
Less than 20	7.6	12.6	14.4 ^a	8.7
20–24	24.4	35.8	39.7 ^a	27.7
25–29	26.2	25.8	24.8	27.9
30–34	24.8	15.9	13.5 ^a	20.9
35–39	13.7	8.0	6.2 ^a	12.0
40 or older	3.3	1.8	1.4 ^a	2.7
Mother's primary language				
English	81.7	74.8	74.1	76.3
Spanish	13.7	21.2	22.9 ^a	17.6
Other	4.6	4.0	3.0 ^a	6.0
Relationship status/family structure				
Married	66.6	47.5	41.3 ^a	60.6
Never married, no partner present	14.4	23.9	27.2 ^a	16.8
Never married, partner present	12.1	18.6	21.2 ^a	13.2
Other marital status	6.8	10.0	10.3	9.4
At least one other child younger than 5 yr in household	38.6	39.8	38.9	41.9
At least one child aged 5–17 in household	38.3	45.7	44.5	48.2
Child is twin or higher order birth	1.7	1.6	1.6	1.5
Birth is mother's first	41.4	38.9	41.9 ^a	32.7
Region and urbanicity				
Northeast	16.4	13.8	12.7 ^a	16.1
Midwest	22.7	20.2	20.0	20.4
South	37.2	39.5	41.0 ^a	36.4
West	23.7	26.5	26.3	27.1
Population at least 50,000	73.5	69.1	67.1 ^a	73.4
Population of 2,500–49,999	12.1	14.2	15.2 ^a	12.1
Population less than 2,500	14.3	16.6	17.6 ^a	14.5
Program participation				
Other program participation since birth of child ^b	40.3	68.2	78.0 ^a	47.4
Mother received welfare most/all of childhood	4.1	6.5	7.5 ^a	4.4
Mother received welfare some/half of childhood	6.8	8.5	9.5 ^a	6.3
Mother did not receive welfare as a child	89.2	85.0	83.0 ^a	89.3
Income/assets/employment				
Household income (1,000s)	49.9	23.0	21.2 ^a	26.8
Income below poverty line	24.8	44.3	49.8 ^a	32.7
Mother employed during year before birth	71.7	64.0	62.8 ^a	66.6
Owns home	47.9	25.1	20.5 ^a	35.1
Owns car or truck	89.4	82.4	80.3 ^a	86.7

continued

TABLE 1
Continued

Characteristics	All Women	Eligible Women	Eligible Participants	Eligible Nonparticipants
Household invests	40.9	15.0	10.3 ^a	25.0
Household has checking or savings account	74.1	56.5	51.5 ^a	67.2
Prenatal care/health				
Prenatal care paid by private insurance	58.6	29.7	19.7 ^a	51.0
Prenatal care paid by Medicaid	33.2	59.3	69.2 ^a	38.2
Prenatal care paid by neither Medicaid nor private insurance	7.0	9.3	9.8	8.3
No prenatal care received	1.3	1.7	1.3	2.5
Gestational age at pregnancy recognition (wk)	5.4	6.0	6.2 ^a	5.6
Mother smoked at least 100 cigarettes in lifetime	33.6	37.3	38.3	35.4
Mother smoked during her third trimester	11.1	15.8	17.4 ^a	12.3
State economic environment and WIC policies				
State poverty rate	11.1	11.4	11.5 ^a	11.2
State unemployment rate	3.9	4.0	4.0 ^a	4.0
SSI confers WIC eligibility	9.0	8.4	8.4	8.5
School lunch confers WIC eligibility	17.8	15.2	13.5 ^a	18.7
WIC offices per 100,000 poor	7.3	7.1	7.0	7.3
WIC-only stores per 100,000 poor	1.5	1.7	1.7	1.7
WIC voucher issued monthly	21.4	24.1	24.6	23.0
All nutritional risk criteria documented	73.7	73.3	71.7 ^a	76.7
Dietary intake information required from all	84.5	85.5	86.1	84.4
Twenty-four-hour recall used for dietary intake	79.2	80.2	79.9	80.6
Food packages tailored for type of milk	85.6	86.1	86.7	84.8
Food packages tailored to reduce sucrose	7.7	9.0	9.0	9.0
Average retail value of WIC food packages (\$)	49.3	49.4	49.4	49.2
Observations	9,150	5,250	3,500	1,750

Notes: All statistics are weighted. Sample sizes are rounded to the nearest 50 per NCES regulations. The percentage of all women participating includes those coded as ineligible.

^aIndicates that the value is significantly different from that of nonparticipants at the 5% level (two-tailed test).

^bOther program participation refers to participation in Medicaid, TANF, or the Food Stamp Program.

participants, Table 2 shows that the rates of participation and eligibility in the 2001 ECLS-B are similar to those in the 1998 Survey of Income and Program Participation as reported in Bitler, Currie, and Scholz (2003). The participation rate of 68% among eligible pregnant women in the ECLS-B (Table 2) is also similar to the rate of 64% (USDA, 2006b), which is produced using the methodology adopted by USDA on the recommendation of the National Research Council (Ver Ploeg and Betson, 2003). Further, Table 2 illustrates that the demographic characteristics of WIC participants in the ECLS-B are quite similar to those generated using 2000 data from *WIC Participant and Program Characteristics 2000* (USDA 2002). The two data sets do not compare as well on the income and poverty variables; however, it is not uncommon to find higher reported

incomes among participant households in survey data compared to administrative data (Bitler, Currie, and Scholz, 2003).

IV. METHODS

A. Conceptual Model

Individuals who are eligible for benefits from means-tested transfer programs do not always receive them, which has prompted research on the factors that may account for nonparticipation among potentially needy households. Most economic research uses a cost-benefit framework to explain the participation decision of eligible individuals. A utility maximizing individual will participate if the benefits received from the program outweigh the costs associated with participation. This

TABLE 2
Comparison of ECLS-B, SIPP, and WIC PC Data

	ECLS-B	1998 SIPP	2000 WIC PC
WIC participation rates			
% of women eligible	56.0	54.1	NA
% of women participating	41.0	38.3	NA
% of eligibles participating	68.0	66.5	NA
Age of WIC participants (yr)			
Less than 35	92.5	89.2	93.8
35 or older	7.5	10.8	6.1
Race/ethnicity of WIC participants			
Non-Hispanic white	39.4	48.1	40.0
Non-Hispanic black	22.2	23.7	20.6
Hispanic	33.6	23.5	34.3
Other	4.8	4.7	5.1
Income of WIC participants			
Average family income	23,519	21,806	13,256
Percent at or below poverty line	46.2	NA	51.6
Percent at or below 185% of poverty line	81.5	NA	83.7

Notes: ECLS-B estimates are weighted. The percentage of women participating and the sample used to generate demographic characteristics from the ECLS-B include those coded as ineligible. The 1998 SIPP, from Bitler, Currie, and Scholz (2003), are based on both pregnant women and women in the postnatal period. The 2000 WIC PC data are from *WIC Participant and Program Characteristics 2000* (USDA, 2002). NA = not available; SIPP = Survey of Income and Program Participation.

model can be extended to explain the timing of participation, with an individual reevaluating her decision to participate in the program at certain intervals.

As described by Currie (2006), economic research has focused on two primary costs of participation—stigma and transactions costs—to explain nonparticipation among eligible individuals. Stigma is first incorporated in the cost-benefit framework by Moffitt (1983) who describes it as the “disutility arising from participation in a welfare program per se” (p. 1023). A utility maximizing individual may feel embarrassed or ashamed about receipt of assistance from the government, and particularly about having others know about their receipt of this assistance. Transactions costs are the costs (both money and time) associated with applying for a program, documenting eligibility, complying with program rules, and redeeming benefits.

The cost-benefit framework assumes that participants have complete information about the costs and benefits of participation. Currie (2006) notes that research has also considered whether a lack of information about the program and its eligibility criteria influence program participation.

B. Statistical Model

We use probit regression analysis to estimate equations explaining any prenatal WIC participation and early prenatal WIC participation. The equations include variables that capture the benefits of participation, the stigma or transactions costs associated with participation, and the availability of information on the program. Many of the included variables could be attributable to more than one of these determinants of participation; therefore, we do not assign each variable to a specific factor. The equations also include independent variables to control for socioeconomic characteristics.

The characteristics displayed in Table 1 are included as explanatory variables. We include variables that indicate the mother’s race and ethnicity (with non-Hispanic white as the basis), the mother’s education (with no high school diploma as the basis), the mother’s age (with age less than 20 as the basis), the mother’s primary language (with primary language of English as the basis), the mother’s relationship status (with married as the basis), the presence of a child (other than the interview child or twin) younger than 5 yr in the

household, the presence of a child between the ages 5 and 17 in the household, whether the survey child is a twin or part of a higher order birth, and whether the interview child is the mother's first. We include indicator variables for the region of residence (with residence in the West as the basis), and two indicator variables for living in an urban area either with a population of at least 50,000 or with a population between 2,500 and 49,999 people (with residence in a rural area as the basis).

We capture a woman's experience with other assistance programs with an indicator variable for participation in TANF, the Food Stamp Program, or Medicaid since the birth of the child, and two variables for the amount of time—either some or half of the time or most or all the time—the household received cash welfare during the mother's childhood (with no cash welfare receipt as the basis). Although participation in other assistance programs after the birth of the child would not directly influence the prenatal WIC participation decision, we include this variable as a proxy for a mother's need for, knowledge of, and willingness to participate in assistance programs.

We also include household income, an indicator variable for household income below the poverty line, and an indicator variable for being employed any time during the 12 mo prior to the child's birth. We characterize the woman's assets with indicator variables for home ownership, for car or truck ownership, for having investments, and for having a savings or checking account.

We include variables to describe characteristics related to a woman's prenatal care and general health. The equation includes variables that indicate whether the woman had prenatal care other than her WIC visits and how she paid for it (with payment through private insurance but not Medicaid as the basis).¹⁰ We include a variable that indicates that the woman has smoked at least 100 cigarettes during her lifetime, a variable that indicates that the woman smoked during the third trimester of her pregnancy, and a variable for the number of weeks into her pregnancy when the mother found out that she was pregnant, which we refer to as gestational age at pregnancy recognition.

10. We also examined the type of prenatal care a woman received (whether at a doctor's office, clinic, or other setting) and found that it did not influence WIC participation.

We include two variables to describe the economic environment in the state—the poverty rate and the unemployment rate. In addition, variables are included to capture state-level WIC policies that may affect WIC participation. A number of these policies is expected to decrease the transactions cost of WIC participation. In some states, household receipt of Supplemental Security Income (SSI) or Free or Reduced Price National School Lunch Program confers income eligibility for WIC, so that participants in these programs do not have to provide further documentation to establish income eligibility. The number of WIC offices per 100,000 poor people in the state is included as a measure of access to the program. WIC-only stores are designed to facilitate the redemption of WIC vouchers and reduce the stigma of doing so. Therefore, we also include the number of WIC-only stores per 100,000 poor people in the state.

Another set of state policy variables is expected to increase the transactions cost of WIC participation. One variable indicates whether states require prenatal WIC participants to pick up WIC vouchers every month, rather than every 2 or 3 mo. A variable is included to indicate that the state documents every identified nutritional risk of participants, rather than just the primary nutritional risks. We include an indicator variable for whether WIC offices in the state collect dietary intake information from all, rather than just high-risk, participants and an indicator variable for whether dietary intake information is collected through 24-h recall, which is estimated to be more time-consuming than a food frequency checklist, the other main method for collecting dietary intake information (Institute of Medicine, 2002). We also include an interaction term that indicates that the state both collects dietary intake information from all participants and uses 24-h recall as the data collection method.

Finally, three variables are included to represent state-level differences in the WIC benefit packages. Two of the variables indicate whether a certified WIC staff person is allowed by the state to tailor an individual's food package according to her nutritional needs or preferences. One variable indicates whether the state allows the type of milk to be specified to reduce fat, lactose, or calories, and another variable indicates whether the state allows the sucrose content of cereal to be reduced. It is

not clear how these tailoring practices will influence WIC participation. The average retail value of the WIC food package, which can vary across states as a result of food package tailoring practices and differences in food prices, is also included.

We first investigate the decision to participate in WIC in the prenatal period and then examine the timing of WIC participation. To examine the decision to participate, the dependent variable is an indicator variable that equals 1 if the woman participated in WIC during the prenatal period, and 0 otherwise. To explore the timing of prenatal WIC participation, we estimate equations explaining (1) WIC participation that begins in the first trimester (early participation) among the sample of prenatal WIC participants and (2) WIC participation that begins in the second trimester among a subsample of prenatal WIC participants who begin participation in either the second or the third trimester. It is useful to consider the factors that influence entrance in the second trimester rather than the third trimester, which provides more exposure to program benefits.

All probit regressions are weighted using a weight constructed to adjust for survey non-response and to reflect population totals, based on the information from birth certificates.¹¹ Marginal effects evaluated at the means of the independent variables are presented, and standard errors are adjusted to account for heteroskedasticity and clustering at the state level since all mothers in a state face the same WIC policies and environment.

V. RESULTS

A. Any Prenatal WIC Participation

As shown in Table 1, among eligible women, those who choose to participate appear to be more disadvantaged than those who do not. Women who participate in WIC are more likely to be non-Hispanic black or Hispanic, to have less than a high school education, to be younger, to have never been married, to participate in other assistance programs, and to have income that falls below the poverty line than their nonparticipant counterparts.

The results of the probit regression of any prenatal WIC participation are displayed in

Table 3. Column (1) displays marginal effects from a probit regression with our main specification, which includes WIC state policy variables. Our findings on the relationship between WIC participation and race, ethnicity, education, and state-level WIC policies are largely consistent with the previous literature. The results indicate that WIC participants are generally more disadvantaged than eligible nonparticipants. We find further evidence of negative selection when we examine the factors that have not been included in most previous studies of prenatal WIC participation. Women who participate in TANF, the Food Stamp Program, or Medicaid after the birth of their child and those who smoked during the third trimester of pregnancy are more likely to participate in WIC. WIC participation decreases with income and is lower among those with a home or other investments. Women who have their prenatal care paid for by Medicaid are more likely to participate in WIC than those with access to private health insurance to pay for their prenatal care. This is not surprising since Medicaid participants are automatically income eligible to receive WIC. We also find that women who use neither Medicaid nor private health insurance are more likely to use WIC than those with private health insurance.

Our regression results indicate that women who have twins or a higher order birth and those having their first child are more likely to participate, while those who live in urban areas or the Northeast are less likely to participate. WIC participation is negatively correlated with the state poverty rate, but the coefficient estimate is quite small. Prenatal WIC participation is higher among women who live in states where SSI participation confers WIC income eligibility, which is expected since this policy reduces the transactions cost of WIC participation. WIC participation is also higher among women who live in states where the value of the WIC food package is higher, which is also expected. The only counterintuitive result is that WIC participation is lower among women in states where participation in the free or reduced price school lunch program confers eligibility for WIC. This result is consistent with the descriptive evidence from Table 1 and holds even when we limit the sample to women who have school-age children (results available from authors). It may be that states with low participation

11. The unweighted probit regressions results are quite similar.

TABLE 3
Marginal Effects from Probit Regressions: Any Prenatal WIC Participation Among Eligible Women

	Probit with State Policy Variables (1)	Probit, No State Policy Variables (2)	State Fixed Effects Probit (3)
Mother's race/ethnicity, education, and age			
Non-Hispanic black	0.083** (0.027)	0.084** (0.028)	0.089** (0.028)
Hispanic	0.088* (0.039)	0.078† (0.038)	0.109* (0.043)
Asian	−0.060 (0.045)	−0.046 (0.047)	−0.049 (0.044)
Other race	0.089* (0.034)	0.077* (0.034)	0.082* (0.034)
High school graduate	0.003 (0.021)	−0.001 (0.021)	0.003 (0.023)
Some college or vocational degree	−0.044† (0.025)	−0.048† (0.026)	−0.039 (0.027)
College graduate	−0.200** (0.043)	−0.210** (0.043)	−0.197** (0.044)
Age 20–24	0.034 (0.034)	0.032 (0.035)	0.035 (0.035)
Age 25–29	−0.015 (0.037)	−0.009 (0.036)	−0.019 (0.038)
Age 30–34	−0.024 (0.042)	−0.018 (0.041)	−0.034 (0.043)
Age 35–39	−0.080 (0.054)	−0.080 (0.051)	−0.085 (0.056)
Age 40 or older	−0.036 (0.053)	−0.025 (0.053)	−0.038 (0.055)
Mother's primary language			
Spanish	0.053 (0.036)	0.048 (0.035)	0.043 (0.038)
Other	0.024 (0.052)	0.005 (0.057)	0.001 (0.052)
Relationship status/family structure			
Never married, no partner present	0.030 (0.036)	0.030 (0.035)	0.026 (0.036)
Never married, partner present	0.044 (0.041)	0.047 (0.040)	0.040 (0.041)
Other marital status	0.027 (0.032)	0.030 (0.032)	0.020 (0.032)
At least one other child younger than 5 yr in household	−0.003 (0.019)	−0.006 (0.019)	0.002 (0.019)
At least one child aged 5–17 in household	0.011 (0.018)	0.007 (0.018)	0.013 (0.019)
Child is twin or higher order birth	0.077** (0.022)	0.082** (0.023)	0.078** (0.022)
Birth is mother's first	0.043† (0.025)	0.044† (0.025)	0.044† (0.024)
Region and urbanicity			
Northeast	−0.095† (0.053)	−0.127** (0.040)	−0.369* (0.159)
Midwest	−0.004 (0.033)	−0.056 (0.042)	−0.026 (0.104)
South	0.002 (0.039)	−0.069† (0.042)	−0.122 (0.095)
Population at least 50,000	−0.101** (0.031)	−0.111** (0.033)	−0.067† (0.034)
Population of 2,500–49,999	−0.024 (0.030)	−0.035 (0.027)	−0.015 (0.029)
Program participation			
Other program participation since birth of child ^a	0.168** (0.020)	0.164** (0.021)	0.177** (0.022)
Mother received welfare most/all of childhood	0.028 (0.037)	0.028 (0.036)	0.019 (0.040)
Mother received welfare some/half of childhood	0.030 (0.045)	0.028 (0.045)	0.023 (0.047)
Income/assets/employment			
Household income (1,000s)	−0.002* (0.001)	−0.002* (0.001)	−0.002* (0.001)
Income below poverty line	−0.017 (0.028)	−0.020 (0.028)	−0.015 (0.028)
Mother employed during year before birth	−0.007 (0.024)	−0.011 (0.024)	−0.002 (0.024)
Owens home	−0.042† (0.023)	−0.040† (0.022)	−0.037† (0.023)
Owens car or truck	0.044 (0.039)	0.041 (0.039)	0.049 (0.040)
Household invests	−0.078** (0.029)	−0.081** (0.028)	−0.083** (0.030)
Household has checking or savings account	0.012 (0.022)	0.012 (0.022)	0.011 (0.023)
Prenatal care/health			
Prenatal care paid by Medicaid	0.182** (0.032)	0.181** (0.034)	0.200** (0.031)
Prenatal care paid by neither Medicaid nor private insurance	0.119** (0.029)	0.112** (0.030)	0.127** (0.028)
No prenatal care received	−0.095 (0.075)	−0.073 (0.076)	−0.090 (0.075)
Gestational age at pregnancy recognition (wk)	0.001 (0.002)	0.002 (0.002)	0.001 (0.002)
Mother smoked at least 100 cigarettes in lifetime	−0.011 (0.020)	−0.010 (0.020)	−0.017 (0.019)

continued

TABLE 3
Continued

	Probit with State Policy Variables (1)	Probit, No State Policy Variables (2)	State Fixed Effects Probit (3)
Mother smoked during her third trimester	0.049† (0.028)	0.051† (0.028)	0.050† (0.028)
State economic environment and WIC policies			
State poverty rate	−0.012† (0.007)		
State unemployment rate	0.030 (0.021)		
SSI confers WIC eligibility	0.111** (0.034)		
School lunch confers WIC eligibility	−0.147** (0.040)		
WIC offices per 100,000 poor	−0.001 (0.002)		
WIC-only stores per 100,000 poor	0.005 (0.007)		
WIC voucher issued monthly	0.031 (0.040)		
All nutritional risk criteria documented	−0.038 (0.036)		
Dietary intake information required from all	0.071 (0.063)		
Twenty-four-hour recall used for dietary intake	0.019 (0.087)		
Dietary intake information required × 24-h recall	−0.044 (0.081)		
Food packages tailored for type of milk	0.027 (0.037)		
Food packages tailored to reduce sucrose	−0.023 (0.028)		
Average retail value of WIC food packages (\$)	0.008* (0.004)		
Pseudo R^2	0.168	0.157	0.184
Observations	5,250	5,250	5,250

Notes: Regressions are weighted. Standard errors are given in parentheses and adjusted for heteroskedasticity and clustering at the state level. Marginal effects are calculated at the means of the independent variables. Missing value indicator variables are included for the variables (with coefficient estimate for column (1) in parentheses): birth is mother's first (.06*), household invests (−.26*), household has checking/savings account (.12), and the two indicators of mother's welfare receipt during childhood (.12*). Excluded groups are: non-Hispanic white; less than high school degree; less than 20 yr of age; primary language is English; married; West; population less than 2,500; mother did not receive welfare as a child; and prenatal care paid by private health insurance. Sample size is rounded to the nearest 50 per NCES regulations.

^aOther program participation refers to participation in Medicaid, TANF, or the Food Stamp Program.

†Significant at 10%; *significant at 5%; **significant at 1%.

in WIC are making it easier to participate by conferring adjunctive eligibility to school lunch program participants.

Three of the WIC state policies that have been examined in previous work—the hematocrit and hemoglobin cutoff values used to establish nutritional risk, and whether applicants are required to provide income documentation to establish eligibility—became more standardized during the period of our analysis. Federal guidelines, effective in 2000, require that all WIC applicants provide some form of income documentation. In addition, since 1999, states choose the criteria they use to determine nutritional risk from a national list with uniform values for hematocrit and hemoglobin cutoff levels. Therefore, these policies are not included as explanatory variables in our main specification. However, we do include variables that describe the policies regarding hematocrit and hemoglobin cutoff values and income documentation that were in effect in the state in 1998 in an alternative

specification (results available from authors). Interestingly, prenatal WIC participation in 2001 is 12.5 percentage points lower in states that required income documentation in 1998 than in states that did not. This suggests a possible lag between the effective date of the standardized income documentation policy and its implementation. However, it may be that a state's 1998 income documentation policy is correlated with other unobservable state characteristics that influence participation. We cannot directly test whether the state's 1998 income documentation policy is correlated with other unobserved state characteristics, but we do find that it is not correlated with the other state WIC policies included in our analysis, which lends some support to the argument that the variable is capturing a lag in implementation.

Understanding the relationship between state-level WIC policies and WIC participation can help inform decisions regarding policy design. However, these policies are likely to be correlated with other unobserved characteristics

of the state; therefore, the coefficient estimates on these variables should be interpreted with caution. To test the sensitivity of our regression results to the inclusion of the state policy variables, we examine two other specifications of the prenatal WIC participation equation. The specification in column (2) is identical to that in column (1), except that the WIC state policy variables and state economic conditions are omitted. Column (3) contains the regression results from a state-level fixed effects probit regression without the state-level variables. The state-level fixed effects probit regression controls for state characteristics, both observed and unobserved, that might influence WIC participation.

As shown in column (2), the omission of the state policy variables does not greatly affect our other regression results. In addition, the regression results in column (3) from state-level fixed effects probit regression without WIC state policy variables are similar to those in our main specification. This indicates that within-state differences in the characteristics of eligible pregnant women have a similar association with WIC participation as do cross-state differences in these characteristics.

To further inform targeting efforts, we also examine prenatal WIC participation among five relatively disadvantaged subgroups of women eligible for WIC: (1) Hispanics, (2) high school dropouts aged older than 18 yr, (3) teen mothers, (4) mothers in households with income below the poverty line, and (5) postnatal Medicaid participants (results available from authors). We find that among high school dropouts and Medicaid participants, prenatal WIC participation is lower in the Northeast than in the West. Among teen mothers, WIC participation is 11.3 percentage points lower among those experiencing their first birth. Compared to teen mothers in the West, those in the Midwest are 15.7 percentage points less likely and those in the South are 21.5 percentage points less likely to participate in WIC during pregnancy. In addition, among Medicaid recipients and the poor, residence in an urban area is associated with lower prenatal WIC participation.

The subgroup analysis also allows us to examine whether there is negative selection into WIC even within these disadvantaged populations. We find evidence that prenatal WIC participants, even among these disadvantaged populations, are more disadvantaged than eli-

gible nonparticipants. Specifically, the likelihood of WIC participation decreases with education, household income, and asset ownership among at least two of these disadvantaged populations. In all five of the subgroups, WIC participation is higher among those who participate in other assistance programs and is lower among those whose prenatal care was paid by private insurance. In contrast to the evidence for negative selection, there is little evidence of positive selection into WIC among the disadvantaged populations. Two examples are that among teenage mothers, Hispanics are less likely to participate than non-Hispanics, and among Hispanic mothers, the poor are less likely to participate than the nonpoor.

B. The Timing of Prenatal WIC Participation

The majority of women who participate during their pregnancy begin participation during their first trimester. However, there is a substantial percentage that begins in the second and third trimesters. According to Table 4, roughly one-third of pregnant WIC participants begin participation during the second trimester, and more than 9% begin participation during their third trimester. Prenatal WIC participants in the 2001 ECLS-B are more likely to enter in the first trimester than those in the 1988 NMIHS data reported in Swann (2007), which is consistent with the increase in the percentage of first trimester entrants found in WIC administrative data between 1992 and 2000 (USDA, 1998, 2003).

We now examine the characteristics of prenatal WIC participants, according to the trimester in which participation began. In Table 5, we compare the characteristics of

TABLE 4
Percentage of Women Who Participate in WIC, by Trimester WIC Receipt Began

	All Eligible Women	Prenatal WIC Participants
Any prenatal WIC participation	68.0	100.0
Began first trimester	39.2	57.6
Began second trimester	22.5	33.1
Began third trimester	6.3	9.3
Observations	5,250	3,500

Notes: Percentages are weighted. Sample sizes are rounded to the nearest 50 per NCES regulations.

TABLE 5
 Characteristics of Eligible Prenatal WIC Participants, by Timing of Their Participation

Characteristics	All WIC (1)	Trimester WIC Receipt Began			
		First (2)	Second (3)	Third (4)	Second or Third (5)
Mother's race/ethnicity					
Non-Hispanic white	38.4	41.0 ^a	33.8	38.4	34.8
Non-Hispanic black	22.4	21.7	24.1	20.0	23.2
Hispanic	34.6	32.9	36.8	37.7	37.0
Asian	1.4	1.1 ^a	1.9	1.7	1.9
Other race	3.2	3.2	3.4	2.2	3.1
Mother's education					
Less than high school	48.5	48.9	47.7	48.2	47.8
High school graduate	29.0	29.3	28.2	29.8	28.6
Some college or vocational degree	19.9	19.8	20.3	19.4	20.1
College graduate	2.6	1.9 ^a	3.8	2.7	3.5
Mother's age (yr)					
Less than 20	14.4	12.1 ^a	18.1	14.9	17.4
20–24	39.7	41.2	38.2	36.1	37.7
25–29	24.8	25.9	21.6 ^b	29.9	23.5
30–34	13.5	13.4	14.3	11.7	13.7
35–39	6.2	6.1	6.3	5.9	6.2
40 or older	1.4	1.3	1.5	1.4	1.4
Mother's primary language					
English	74.1	75.9 ^a	71.9	70.4	71.5
Spanish	22.9	21.4	24.8	25.5	24.9
Other	3.0	2.6	3.4	4.1	3.5
Relationship status/family structure					
Married	41.3	43.2 ^a	37.4	42.7	38.6
Never married, no partner present	27.2	25.7	29.5	28.4	29.3
Never married, partner present	21.2	20.7	22.6	19.2	21.9
Other marital status	10.3	10.3	10.5	9.6	10.3
At least one other child younger than 5 yr in household	38.9	42.8 ^a	33.6	33.4	33.5
At least one child age 5–17 in household	44.5	45.3	44.3	39.6	43.3
Child is twin or higher order birth	1.6	1.4	1.7	2.3	1.8
Birth is mother's first	41.9	36.9 ^a	48.0	50.7	48.6
Region and urbanicity					
Northeast	12.7	11.9	14.8	10.2	13.8
Midwest	20.0	20.5	19.2	20.2	19.5
South	41.0	41.8	40.2	38.2	39.8
West	26.3	25.8	25.7	31.4	27.0
Population at least 50,000	67.1	63.7 ^a	72.2	70.5	71.8
Population of 2,500–49,999	15.2	16.8 ^a	11.9	17.1	13.1
Population less than 2,500	17.6	19.5 ^a	15.9	12.5	15.1
Program participation					
Other program participation since birth of child ^c	78.0	78.8	78.3	72.5	77.0
Mother received welfare most/all of childhood	7.5	9.0 ^a	5.5	5.1	5.4
Mother received welfare some/half of childhood	9.5	8.5	11.7	7.8	10.9
Mother did not receive welfare as a child	83.0	82.5	82.8	87.1	83.8
Income/assets/employment					
Household income (1,000s)	21.2	20.7	21.6	23.2	22.0
Income below poverty line	49.8	49.6	51.1	46.3	50.1
Mother employed during year before birth	62.8	62.2	63.9	62.7	63.6

continued

TABLE 5
Continued

Characteristics	All WIC (1)	Trimester WIC Receipt Began			
		First (2)	Second (3)	Third (4)	Second or Third (5)
Owens home	20.5	21.7	19.2	17.3	18.8
Owens car or truck	80.3	80.7	80.0	79.5	79.9
Household invests	10.3	9.3	10.8	14.8	11.7
Household has checking or savings account	51.5	51.6	50.3	54.8	51.3
Prenatal care/health					
Prenatal care paid by private insurance	19.7	19.5	18.5 ^b	25.2	19.9
Prenatal care paid by Medicaid	69.2	69.9	70.4 ^b	60.6	68.3
Prenatal care paid by neither Medicaid nor private insurance	9.8	9.4	10.3	10.1	10.3
No prenatal care received	1.3	1.2	0.8 ^b	4.1	1.5
Gestational age at pregnancy recognition (wk)	6.2	5.2 ^a	7.4	7.3	7.4
Mother smoked at least 100 cigarettes in lifetime	38.3	39.2	35.9	41.0	37.0
Mother smoked during her third trimester	17.4	18.5	16.3	14.6	15.9
State economic environment and WIC policies					
State poverty rate	11.5	11.5	11.3	11.5	11.4
State unemployment rate	4.0	4.0	4.0	4.1	4.0
SSI confers WIC eligibility	8.4	8.8	7.7	8.1	7.8
School lunch confers WIC eligibility	13.5	11.9 ^a	15.9	14.3	15.6
WIC offices per 100,000 poor	7.0	7.1	7.1	6.4	6.9
WIC-only stores per 100,000 poor	1.7	1.7	1.7	2.0	1.8
WIC voucher issued monthly	24.6	25.2	22.7	27.7	23.8
All nutritional risk criteria documented	71.7	71.4	71.5	74.0	72.0
Dietary intake information required from all	86.1	87.8 ^a	83.8	83.7	83.8
Twenty-four-hour recall used for dietary intake	79.9	81.0	77.2	83.0	78.5
Food packages tailored for type of milk	86.7	86.1	87.8	86.0	87.4
Food packages tailored to reduce sucrose	9.0	9.9	7.7	8.3	7.8
Average retail value of WIC food packages (\$)	49.4	49.3	49.6	49.6	49.6
Observations	3,500	2,050	1,150	300	1,450

Notes: All statistics are weighted. Sample sizes are rounded to nearest 50 per NCES regulations.

^aIndicates that the value is significantly different from that of second or third trimester entrants at the 5% level (two-tailed test).

^bIndicates that the value is significantly different from that of third trimester entrants at the 5% level (two-tailed test).

^cOther program participation refers to participation in Medicaid, TANF, or the Food Stamp Program.

women who begin WIC receipt in the first trimester (column (2)) to those of women who begin WIC receipt in either the second or the third trimester of their pregnancy (column (5)). We find that those who begin WIC in the first trimester (early participants) are different from later entrants over a number of dimensions, although the differences are more muted than those found between participants and eligible nonparticipants. Early participants are more likely to be non-Hispanic white, older, and married. They are also more likely to speak English as their primary language, have another preschool-age child in the household, and have received cash welfare during most or

all of their childhood. Early participants are less likely to be Asian, to be a college graduate, to live in an urban area, and to be giving birth to their first child. On average, early WIC participants recognize their pregnancy over 2 wk sooner than participants beginning WIC participation in the second and third trimesters.

There are fewer statistically significant differences between those who enter WIC in the second trimester (column (3)) rather than the third trimester (column (4)). Those who enter WIC in the second trimester are more likely to have prenatal care and to have it paid for by Medicaid than those who enter in the third trimester. Second trimester entrants are less

likely to have private health insurance pay for their prenatal care than third trimester entrants. Those who enter WIC in the second trimester are quite similar to early participants across these characteristics related to prenatal care.

The results of the probit regressions that examine the timing of prenatal WIC participation are displayed in Table 6. We focus on the results from the probit analysis that includes state-level economic conditions and WIC policies.¹² The table contains the estimation results for an equation predicting early WIC participation among all prenatal WIC participants (column (1)) and among a subsample of second and third trimester participants (column (2)). We also examine the factors associated with early prenatal WIC participation among the five relatively disadvantaged subgroups discussed in the previous section (results available from authors).

As shown in column (1) of Table 6, many of the factors that were found to influence any prenatal WIC participation have a similar influence on early WIC participation. For example, among all prenatal WIC participants, early WIC participants are less likely to have a college degree or to live in an urban area. Early WIC participation decreases with household income. Compared to those who have their prenatal care paid by private health insurance, women who use Medicaid are not more likely to begin participating in the first trimester but are more likely to begin participating in the second trimester rather than the third trimester (column (2)). Although cash welfare receipt during childhood did not influence prenatal WIC participation, we find that WIC participants who received cash welfare during most or all of childhood are more likely to enter early. These findings indicate that even among WIC participants, early participants are negatively selected on some observables. However, there is also evidence of positive selection into early WIC participation over some dimensions. Early WIC entrants are

less likely than later entrants to be Hispanic, to have received cash welfare during some or half of their childhood, and to be poor.

Some of the factors associated with a delay in prenatal WIC participation suggest a lack of information about the WIC program among some populations. Eligible women experiencing a first birth are more likely to participate but are less likely to participate early. Of particular concern are teen mothers experiencing their first birth, who are 24.3 percentage points less likely to participate early than those with a previous pregnancy. In addition, while Hispanic women are more likely to participate in WIC than non-Hispanic white women, they are less likely to begin participation during their first trimester. Additional analysis indicates that language proficiency, citizenship status, and Hispanic subgroup are important factors related to early WIC participation among Hispanics (results available from authors). Hispanic WIC participants who report that they do not speak English well at all are 8 percentage points less likely to enter WIC in their first trimester than those who are more proficient. Unlike many other social assistance programs, WIC extends eligibility to noncitizens. We examine citizenship status and Hispanic subgroup (Mexican, Puerto Rican, or other Hispanic) with a series of interactive indicator variables and find that compared to Puerto Ricans, Mexican citizens are 19.6 percentage points less likely and other Hispanic noncitizens are 23.1 percentage points less likely to participate early. The coefficient estimates on the variables indicating Mexican noncitizens and other Hispanic citizens are also negative and of roughly the same magnitude but are not statistically significant.

The timing of a pregnant woman's WIC participation is also influenced by when she finds out she is pregnant. Delayed pregnancy recognition is associated with a lower probability of early WIC receipt. In addition, later recognition of pregnancy reduces early WIC participation within all the disadvantaged subgroups. There is a particularly strong effect among teenage mothers, where, at the mean, a 1-wk delay in finding out about her pregnancy reduces the probability of first trimester WIC participation by 5.1 percentage points. Regression analysis of the factors that influence gestational age at pregnancy recognition (results available from authors) shows that

12. We test the sensitivity of our regression results to the other two specifications shown in Table 3 and find that our results are not generally sensitive to the exclusion of state-level variables or the inclusion of state-level fixed effects. An important exception is that the coefficient estimate on the Hispanic variable is insignificant in the two alternative specifications, which illustrates the importance of understanding state-level characteristics that influence WIC participation when estimating the likelihood of early WIC participation by Hispanic participants.

TABLE 6

Marginal Effects from Probit Regressions: Early Prenatal WIC Among Eligible Participants

Analysis Sample of Participants	All Prenatal	Second or Third Trimester Entrants
Trimester Began WIC Receipt	First Trimester (1)	Second Trimester (2)
Mother's race/ethnicity, education, and age		
Non-Hispanic black	-0.036 (0.033)	0.047 (0.036)
Hispanic	-0.066† (0.037)	0.052 (0.046)
Asian	-0.106 (0.070)	0.081 (0.059)
Other race	-0.029 (0.060)	0.077† (0.039)
High school graduate	-0.039 (0.029)	-0.018 (0.034)
Some college or vocational degree	-0.037 (0.043)	0.052† (0.030)
College graduate	-0.156** (0.054)	0.089 (0.046)
Age 20–24	0.063 (0.041)	-0.054 (0.052)
Age 25–29	0.046 (0.044)	-0.146† (0.086)
Age 30–34	0.050 (0.037)	-0.059 (0.073)
Age 35–39	0.067 (0.050)	-0.071 (0.097)
Age 40 or older	0.014 (0.101)	-0.126 (0.172)
Mother's primary language		
Spanish	-0.037 (0.043)	-0.043 (0.049)
Other	-0.076 (0.076)	-0.044 (0.075)
Relationship status/family structure		
Never married, no partner present	-0.010 (0.034)	0.021 (0.039)
Never married, partner present	-0.002 (0.033)	0.046 (0.038)
Other marital status	-0.045 (0.040)	0.033 (0.055)
At least one other child younger than 5 yr in household	0.067* (0.027)	-0.010 (0.030)
At least one child aged 5–17 in household	0.020 (0.026)	0.044 (0.040)
Child is twin or higher order birth	-0.058 (0.042)	-0.061 (0.044)
Birth is mother's first	-0.058† (0.032)	-0.033 (0.035)
Region and urbanicity		
Northeast	0.079 (0.050)	0.047 (0.040)
Midwest	0.062 (0.043)	-0.071 (0.045)
South	0.044 (0.043)	0.045 (0.040)
Population at least 50,000	-0.068* (0.029)	-0.030 (0.038)
Population of 2,500–49,999	-0.008 (0.041)	-0.127† (0.074)
Program participation		
Other program participation since birth of child ^a	0.010 (0.035)	0.011 (0.043)
Mother received welfare most/all of childhood	0.109** (0.038)	-0.003 (0.056)
Mother received welfare some/half of childhood	-0.073* (0.036)	0.065† (0.035)
Income/assets/employment		
Household income (1,000s)	-0.003* (0.001)	-0.001 (0.001)
Income below poverty line	-0.059† (0.031)	-0.015 (0.038)
Mother employed during year before birth	-0.022 (0.022)	0.024 (0.031)
Owens home	0.005 (0.030)	0.036 (0.031)
Owens car or truck	-0.010 (0.025)	0.057* (0.024)
Household invests	-0.052 (0.044)	-0.055 (0.048)
Household has checking or savings account	0.013 (0.021)	-0.032 (0.031)
Prenatal care/health		
Prenatal care paid by Medicaid	0.025 (0.037)	0.081* (0.036)
Prenatal care paid by neither Medicaid nor private insurance	0.004 (0.049)	0.060 (0.053)
No prenatal care received	-0.038 (0.110)	-0.367** (0.149)
Gestational age at pregnancy recognition (wk)	-0.033** (0.003)	-0.002 (0.003)
Mother smoked at least 100 cigarettes in lifetime	-0.016 (0.029)	-0.077* (0.034)
Mother smoked during her third trimester	0.009 (0.032)	0.060 (0.038)

continued

TABLE 6
Continued

Analysis Sample of Participants	All Prenatal	Second or Third Trimester Entrants
Trimester Began WIC Receipt	First Trimester (1)	Second Trimester (2)
State economic environment and WIC policies		
State poverty rate	0.005 (0.005)	-0.012 (0.008)
State unemployment rate	0.021 (0.013)	0.014 (0.029)
SSI confers WIC eligibility	0.045 (0.038)	-0.030 (0.040)
School lunch confers WIC eligibility	-0.040 (0.037)	0.026 (0.036)
WIC offices per 100,000 poor	-0.001 (0.001)	0.004* (0.002)
WIC-only stores per 100,000 poor	0.000 (0.006)	0.001 (0.009)
WIC voucher issued monthly	0.021 (0.033)	0.009 (0.051)
All nutritional risk criteria documented	-0.038 (0.031)	-0.024 (0.041)
Dietary intake information required from all	0.002 (0.059)	0.105 (0.093)
Twenty-four-hour recall used for dietary intake	-0.009 (0.069)	-0.006 (0.083)
Dietary intake information required \times 24-h recall	0.101 (0.073)	-0.047 (0.081)
Food packages tailored for type of milk	0.012 (0.037)	0.052 (0.046)
Food packages tailored to reduce sucrose	0.077** (0.028)	-0.016 (0.038)
Average retail value of WIC food packages (\$)	-0.004 (0.003)	0.000 (0.003)
Pseudo R^2	0.086	0.068
Observations	3,500	1,450

Notes: Regressions are weighted. Standard errors are given in parentheses and adjusted for heteroskedasticity and clustering at the state level. Marginal effects are calculated at the means of the independent variables. Missing value indicator variables are included for the variables (with coefficient estimate for column (1) in parentheses): birth is mother's first (.00), household invests (.10), household has checking/savings account (-.09), and the two indicators of mother's welfare receipt during childhood (.05). Excluded groups are: non-Hispanic white; less than high school degree; less than 20 yr of age; primary language is English; married; West; population less than 2,500; mother did not receive welfare as a child; and prenatal care paid by private health insurance. Sample sizes are rounded to nearest 50 per NCES regulations.

*Other program participation refers to participation in Medicaid, TANF, or the Food Stamp Program.

†Significant at 10%; *significant at 5%; **significant at 1%.

women who are more disadvantaged find out about their pregnancies later. These findings suggest that policies that promote an earlier recognition of pregnancy may increase early participation in WIC.

While state-level policies influence any prenatal WIC participation, they do not have as much effect on the timing of WIC participation. Women in states in which WIC food packages can be tailored to reduce sucrose content are more likely to enter WIC in their first trimester. It is possible that the tailoring of food packages may represent a greater level of WIC services to prenatal participants. There is a positive association between second, rather than third, trimester entrance into WIC and the number of WIC offices in a state.

The examination of early prenatal WIC participation among the disadvantaged subgroups provides some further evidence to aid targeting efforts. We find that among

three of the four relevant groups, non-Hispanic black and/or Hispanic women are less likely than white women to participate in the program early. Teen mothers who participate are more likely to enter early in the South than those in the West, and Medicaid recipients in the Northeast and the South are more likely to enter early than those in the West. The evidence on selection into early WIC participation among disadvantaged participants is mixed. We find that early WIC participation decreases with education in all the three relevant subgroups, which suggests negative selection into early participation. In addition, among three of the five subgroups, women who are unmarried and those who received cash welfare all or most of the time growing up are more likely to enter WIC in the first trimester. However, there is also evidence of positive selection into early WIC participation over some observable characteristics. For example, as previously noted,

a delay in pregnancy recognition reduces early WIC participation among all five subgroups of participants.

VI. CONCLUSIONS

Given the benefits of prenatal WIC participation, this paper examines factors associated with any WIC participation during pregnancy and with early participation. Overall, our findings on the factors associated with WIC participation are consistent with those found in previous studies that suggest negative selection into WIC. We also find that additional factors, which have not been studied before, are important in explaining WIC participation. These findings provide further evidence of negative selection into WIC related to observable characteristics such as assistance program participation, low household income and assets, and lack of access to private health insurance.

In addition, we find evidence that WIC participants who enroll early in their pregnancies are more disadvantaged in some ways than those who enroll later. However, there are some key differences between the results examining any participation and the timing of participation. Hispanic women, especially those with language difficulties, enroll in WIC later in their pregnancies. Early WIC participation, particularly among teenagers, is less likely among women experiencing a first birth and depends on the mother's early recognition of her pregnancy.

Our results can inform both research on the effectiveness of the WIC program and policy efforts to increase early WIC participation among vulnerable populations. While a large body of literature suggests that WIC improves birth outcomes, some recent studies find contradictory evidence. We find evidence of negative selection into prenatal WIC participation across a broader range of observable characteristics than have been included in previous studies. As researchers continue to assess the effectiveness of WIC, it is important to account for the differences between women who participate in WIC and those who are eligible but do not participate, as well as the differences between those who enroll early in their pregnancies and those who enroll later. Failure to account for differences between participants and eligible nonparticipants can lead to biased

estimates of the effectiveness of both any and early WIC participation.

These results can also inform policy design and outreach efforts. The evidence on the strong ties between prenatal Medicaid and WIC suggests that further outreach at Medicaid offices could be effective in increasing participation. In designing outreach activities to increase early participation, it is important to recognize some of the key factors associated with a delay in prenatal WIC participation. Our results suggest that greater outreach efforts to Hispanic women are warranted. These efforts should recognize that a lack of English proficiency is a significant barrier to early prenatal WIC participation. In addition, special attention must be paid to the Hispanic subgroups, such as Mexicans and other non-Puerto Ricans, who have especially low early prenatal WIC participation.

Women having their first child and those who recognize their pregnancy status later, especially those in their teens, are less likely to enter WIC in the first trimester. Broad public health efforts to increase early recognition of pregnancy status combined with greater WIC outreach efforts could ensure that vulnerable populations, particularly teen mothers, have access to the benefits of early prenatal WIC participation.

APPENDIX: STATE-LEVEL WIC POLICIES AND PRACTICES

WIC Eligibility Variables

States may offer automatic WIC income eligibility to individuals who participate in SSI, the Free or Reduced Price National School Lunch Program, or other means-tested transfer programs. Prior to 2000, some states required that applicants provide documentation of income (such as pay stubs, W-2 forms, and letters from employers), while other states allowed applicants to self-declare their income. Federal guidelines, effective in 2000, now require that all applicants provide income documentation, unless they are adjunctively eligible for WIC through participation in other means-tested transfer programs. The variables related to WIC eligibility are:

- “SSI confers WIC eligibility” indicates whether participation in SSI confers automatic WIC income eligibility.
- “School lunch confers WIC eligibility” indicates whether household participation in the Free or Reduced Price National School Lunch Program confers automatic WIC income eligibility.
- “Income documentation is required” indicates whether, in 1998, a state requires applicants to provide documentation of income to determine WIC income eligibility. All states required income documentation in 2000, so this variable is not included in the main specification.

WIC Food Package and Voucher Distribution Variables

Federal guidelines limit the maximum amount of food states can distribute in each food package. Within this limit, state and local agencies may allow for food packages to be tailored to better meet the nutritional needs or preferences of individual WIC participants. For example, some states may allow WIC staff to tailor the type of milk, such as reduced fat or soy, or to specify cereal with reduced sucrose content. States also have discretion over the frequency with which the food instruments (vouchers) are distributed to WIC participants, with distribution periods ranging from 1 to 3 mo. There are seven different WIC food packages, which vary by type of participant. The average retail cost of the food packages for all WIC participants varies by state (from \$33.38 to \$61.84 in 2000), depending on differences in food prices and tailoring allowances (USDA, 2002). The variables related to the WIC food package and voucher distribution are:

- "Food packages tailored for type of milk" indicates whether a state allows for tailoring of the type of milk in food packages.
- "Food packages tailored to reduce sucrose" indicates whether a state allows for tailoring of the type of cereal in food packages to reduce sucrose content.
- "WIC voucher issued monthly" indicates that a pregnant participant must collect the WIC food voucher each month, rather than less frequently.
- "Average retail value of WIC food packages" is the real average cost of food packages for all WIC participants in 2000 dollars.

WIC Offices and WIC-Only Stores

There were 2,196 local WIC offices in the United States in 2000. The share of WIC food sales in WIC-only stores, which serve only WIC customers, has increased dramatically in the past decade, and in 2000, there were 523 WIC-only stores in 13 states (Neuberger and Greenstein, 2004). These stores carry only WIC products and may reduce the difficulties and stigma associated with redeeming WIC vouchers. The variables related to WIC offices and WIC-only stores are:

- "WIC offices per 100,000 poor."
- "WIC-only stores per 100,000 poor."

WIC Nutritional Risk Variables

To receive WIC, an applicant must be determined to be at nutritional risk. Although there is evidence that nearly all income-eligible individuals are at nutritional risk (Ver Ploeg and Betson, 2003), the documentation of nutritional risk can vary across states. Some states require dietary intake information from all participants as part of the nutritional risk assessment, while others require this information only from high-risk participants. There is also variation in the methods used to collect dietary intake information. The two most common collection methods routinely used by states are the 24-h recall and the food frequency checklist. A recent study (Institute of Medicine, 2002), notes that 24-h recall takes an average of 20–30 min, while a food frequency checklist takes an average of 10–15 min to complete. Most WIC applicants except infants take a blood test as part of the nutritional risk determination process. Prior to 1999, states selected criteria for establishing nutritional

risk under broad Federal guidelines. Low hematocrit or hemoglobin values indicate anemia or other nutritional abnormalities. The hematocrit and hemoglobin cutoff values reflect the stringency of the state's nutritional risk requirement prior to 1999, when Federal guidelines required the standardization of nutritional risk criteria. The variables related to nutritional risk are:

- "All nutritional risk criteria documented" indicates that the WIC agencies in the state document all the nutritional risks faced by a participant, rather than documenting just the primary nutritional risks.
- "Dietary intake information required from all" indicates whether states require that dietary intake information be collected from all participants, rather than just high-risk participants, to determine WIC nutritional risk eligibility.
- "Twenty-four-hour recall used for dietary intake" indicates that the state routinely uses the 24-h recall method to collect dietary intake information.
- "Hematocrit cutoff values" refer to the state's WIC nutritional risk eligibility cutoff for hematocrit values among pregnant women in 1998. Nutritional risk criteria were standardized at the national level in 1999, so this variable is not included in the main specification.
- "Hemoglobin cutoff values" refer to the state's WIC nutritional risk eligibility cutoff for hemoglobin values among pregnant women in 1998. Nutritional risk criteria were standardized at the national level in 1999, so this variable is not included in the main specification.

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